GLADIOLUS FLOWER AND CORM PRODUCTION IN RELATION TO METHODS OF CURING CORMS[1]

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Abstract. **Large (jumbo) corms of 'Peter Pears' and small (No. 5) corms of 'Friendship' were dug June 25, 1973 and cured at 75° F (24° C) and 92° F (33° C) with low and medium velocities of 85% relative humidity air. Corms were cleaned either at harvest or after curing. Two curing durations, 6 and 12 days, were used. Early flowering was promoted by curing for only 6 days at the higher temperature and by cleaning after curing. Good flower production was associated with 6 days of curing at either temperature and with the low air movement. Cleaning corms after curing was superior to cleaning at harvest time, especially when cured at the higher temperature. With respect to total harvests, poorest flower and corm production resulted from the greater air velocity on cleaned corms cured for 12 days. Flower and subsequent corm production were correlated with loss of corm weight during curing in excess of 10-12%.**

The curing of gladiolus corms has been considered to be a drying process (1, 3, 5). Heated air is blown around the freshly harvested corms held in slatted trays or mesh bags. Various workers (1, 2, 3, 5, 10) reported that quick drying and/or temperatures of 90-95°F (32-35°C) reduced corm rots caused by *Fusarium oxysporum* Schlect. f. sp. *gladioli* (Massey) Sny. & Hans., *Botrytis gladiolorum* Timm. and *Penicillium* sp. Corms grown in Florida are generally cured in open sheds for about 14 days at ambient temperatures of about 60 to 90°F. On some Florida farms, corms are cleaned, treated with a fungicide and placed in cool storage one or two days after being harvested (6, 7). Corms with little or no curing before cool storage are removed to warm air (70-85°F) 7 to 14 days before planting in order to develop root growth (6, 7).

Magie (8) reported that rapid loss of corm moisture after surface was dried reduced yields. He also reported (9) that a loss of corm weight in excess of 10 to 12% during the first 6 days of curing was detrimental and that yield losses were directly proportional to excess weight losses. Shilo and Simchon (12) reported that artificial drying of large corms, resulting in a weight loss of 20% or more, caused multiple sprouting of corms and reduced flower quality.

Artificial heat is also used to prevent sprouting in non-dormant or slightly dormant corms destined for ship-transport 2 to 4 months after harvest (8). Such corms are "cured" slowly so that they are shrunken, leaving them with loose husks. When used in Florida, shrunken corms are reported by growers to produce smaller flower spikes than comparable non-dried corms.

This report is based on a study that was conducted to determine the optimum corm curing treatments for flower and corm production in Florida.

Materials and Methods

A factorial design was used for the experiment with jumbo corms (18 cm in cir.) of 'Peter Pears' cv. and No. 5 (4-6 cm. circ.) corms of 'Friendship' cv. Corms were dug June 26, 1973 near Bradenton, Florida and half of the corms of each cultivar were cleaned the same day. Both the cleaned and uncleaned corms were soaked for 10 minutes in a solution of Dowicide B (sodium 2,4,5-trichlorophenate, 85%) at 2½ lb/100 gal. on the day of digging. The cleaned corms were weighed on June 27 and again on July 3 or 9. All corms were placed in 4 curing cabinets on June 27 (11). Conditioned air was blown constantly through the corms held in mesh sacks at one of two velocities. The environmental conditions in individual cabinets were 1) 75°F (24°C) and 5 ft. per min., 2) 75° and 40 ft. per min., 3) 92°F (33.4°C) and 5 ft. per min. and 4) 92° and 40 ft per min. A relative humidity of approximately 85% was held in all cabinets. Half of the corm lots, both cleaned and uncleaned, were removed after 6 days of curing and the remainder after 12 days. Uncleaned corms were cleaned when removed from cabinets.

All corms were placed in cool storage at 40°F (5°C) on July 10. Relative humidity of storage

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Table 1. Percent weight loss of cleaned corms during curing periods with two air velocities.

	5 feet per minute				40 feet per minute				Mean		
	6 days		12 days		6 days		12 days		6	12	
Temperature, °F	PP[z]	Fr	PP	Fr	PP	Fr	PP	Fr	days	days	Mean
75	6	10	7	19	8	17	12	26	10	16	13
92	9	14	10	22	10	24	14	31	14	19	17
Mean		12				18			12	18	

[z]PP = 'Peter Pears' cv; Fr = 'Friendship' cv.

air was 70-75%. Corms were removed on October 15 and planted October 16 with treatments randomized in replicated blocks of cultivars, 40 corms per 10 foot plot. Both at planting and at harvest, corms were free of symptomatic lesions of the Fusarium disease. A count of emerged shoots was made on November 8. Number and weight of flower spikes was recorded four times per week. Corms were dug, cleaned, counted and weighted 19 weeks after planting.

Results

The percentage weight loss of corms during the curing periods is shown in Table 1. Corms lost more weight as curing temperature, time period and air speed were increased. Weight loss was increased 50% by increasing air velocity or by doubling duration of curing. Percent losses ranged from 6 to 14 for large corms and 10 to 31 for small corms. Further weight loss during 3 months

Table 2. Number of plants emerged per 80 corms, 23 days after planting 'Peter Pears'.

		Air at 5 ft/min.		Air at 40 ft/min.		Means		
Temperature, °F	Cleaning	6 days	12 days	6 days	12 days	6 days	12 days	Cleaning
75	--	99	87	95	87			
92	--	119	94	109	75			
Mean		109a[y]	91bc	102ab	81c	106[x]	86	
--	NC[z]	110	98	110	88			102
--	C	108	83	94	74			90

[z]NC = corms not cleaned before curing; C = corms cleaned before curing.

[y]Mean separation by Duncan's multiple range test, 5% level.

[x]Emergence of plants for 6 days of curing is significantly greater at 5% level than for 12 days.

Table 3. Number of 'Peter Pears' and 'Friendship' flower spikes cut per 80 corms in first 4 harvests with respect to duration of curing at two temperatures.

Temperature, °F	6 days NC[z]	6 days C	12 days NC	12 days C	Means NC	Means C	Means Mean
75	103	78	67	63			78
92	116	96	83	69			91
Mean	98[y]		71		92[y]	77	

[z]NC = not cleaned before curing; C = cleaned before curing.

[y]Mean is significantly greater than corresponding mean at 5% level.

of storage at 40°F was limited to an average of 1.3% for large and 3% for small corms.

The count of 'Peter Pears' plants (Table 2) shows that 12 days of curing delayed emergence compared to 6 days. The number of flower spikes cut in the first 4 harvests, which indicate earliness of bloom, are shown in Table 3. Six days of curing produced 38% more early cut flowers than 12 days and cleaning corms after curing increased early cut flowers by 19% over cleaning at harvest.

Yields of 'Peter Pears' flower spikes and corms (Table 4) show that the shorter curing period at either temperature was superior to the longer period at the higher temperature. At the higher temperature, flower yield was reduced 17% when curing was increased from 6 to 12 days and corm yield was reduced by 20%. Regardless of curing period and temperature, cleaning corms before curing reduced corm yield when corms were subjected to the more rapid air movement. Flower weights (not shown) had differences similar to the data on number of flowers.

Yields of 'Friendship' flower spikes and corms (Table 5) show that flower production was reduced

Table 4. Flower and corm yields from 80 corms of 'Peter Pears' in relation to curing duration at two temperatures and two air velocities.

Temperature, °F	Cleaning	Air at 5 ft/min 6 days	Air at 5 ft/min 12 days	Air at 5 ft/min Mean	Air at 40 ft/min 6 days	Air at 40 ft/min 12 days	Air at 40 ft/min Mean	Mean 6 days	Mean 12 days
		Number of flower spikes harvested during full season							
75	--	93	88		93	90		93a[y]	89ab
92	--	97	82		91	73		94a	78b
--	NC[z]			92			92		
--	C			88			81		
		Number of corms harvested							
75	--	90	86		93	95		92a[y]	91a
92	--	102	82		93	73		98a	78b
--	NC			92ab[y]			95a		
--	C			88ab			82b		

[z]NC = corms not cleaned before curing; C = corms cleaned before curing.

[y]Mean separation by Duncan's multiple range test, 5% level.

by increasing curing period at the higher temperature and that cleaning corms prior to curing at the higher air velocity was deleterious to flower production compared to curing with low velocity and cleaning after curing. Corm production was reduced by curing for 12 days with rapid air movement at 92°F compared to curing at either temperature for 6 days. Corm weights showed similar differences and are not given.

Discussion

Cleaning corms at harvest followed by 12 days of curing at 92°F were detrimental to both flower and corm production, compared to 6 days at either temperature with corms cleaned after curing. The deleterious effects of the greater air velocity agree with published results of other experiments (8, 9). Both the large corms of 'Peter Pears' and small corms of 'Friendship' were affected *similarly with* respect to flower and corm production.

The detrimental effect of prolonged curing, especially on cleaned corms, was correlated with the higher losses of corm weight in curing. Conditions of curing that increased corm drying, including length of period, removal of roots and "mother" corms, higher temperature and air velocity, tended to retard emergence of plants and to reduce number of early flowers as well as to reduce yields.

Since the Fusarium disease was a minor factor in the yields reported, the results differ in some respects from those reported (9) when corm stocks were affected with *Fusarium*. In both cases, regardless of *Fusarium* potential, weight loss in large corms, exceeding 10-12% during the first 6 to 12 days, reduced flower and corm production in direct proportion to weight loss above 10-12%.

Table 5. Flower and corm yields from 80 corms of 'Friendship' in relation to curing duration at two temperatures and two air velocities.

Temperature, °F	Cleaning	Air at 5 ft/min 6 days	Air at 5 ft/min 12 days	Air at 5 ft/min Mean	Air at 40 ft/min 6 days	Air at 40 ft/min 12 days	Air at 40 ft/min Mean	Mean 6 days	Mean 12 days
		Number of flower spikes harvested during full season							
75	--	37	34		36	31		37a[y]	32ab
92	--	37	28		36	26		36a	27b
--	NC[z]			37a[z]			35ab		
--	C			31ab			29b		
		Number of corms harvested							
75	--	74	69		75a[z]	66ab		74	68
92	--	79	68		73a	56b		76	62
--	NC			74			72		
--	C			71			63		

[z]NC = corms cleaned after curing; C = corms cleaned before curing.

[y]Mean separation by Duncan's multiple range test, 5% level.

Small, cleaned corms in the present experiment tolerated about 20% loss of weight without a severe reduction in yield of flowers. The effect of the higher temperature in protecting against disease loss in corms which were protected against excessive moisture loss, as reported earlier (8), was not seen in the present experiment.

Flower and corm yields were affected similarly, indicating that "splitting" or multiple sprouting of corms did not affect flower or corm yields in the present study. That there was no corm splitting is consistent with Shilo and Simchon's report (12) that a 10% loss of corm weight did not induce extra sprouts in large corms as did 20% or more weight losses during curing and storage.

Although excessive loss of corm moisture is reported to reduce productivity of cultivars grown in the winter season in Florida (8, 9) and Israel (12), Farrington (4) reported that most cultivars adapted only to summer culture may be cured and stored under drying conditions that would reduce productivity of cultivars adapted to winter production. The relatively few cultivars partly adapted to winter-time-culture were all selected under long-daylight conditions and are therefore generally grown in all seasons of the year. According to Farrington's experiments, corm drying conditions deleterious to the few cultivars that produce long flower spikes in the short daylight hours of winter are beneficial to the cultivars adapted only to summer growing. Marshall (10) reported that corm periderm developed more rapidly and protected better against Fusarium infections when a curing temperature of 95°F (35°C) was used as compared with lower or higher temperatures.

The possibility that warm curing is more effective in developing an effective periderm in summer-adapted than in winter-adapted cultivars should be investigated. The periderm may be developed more rapidly and/or may be thicker or more retentive of moisture in cultivars not adapted to winter culture. If so, their reported tolerance of corm drying conditions might be explained. Farrington (4) relates tolerance of drying to genetic background, i.e. to winter-flowering and summer-flowering species that were used in hybridizing the many cultivars of *Gladiolus grandiflora* Hort.

The experiments reported in Florida (8, 9) and in Israel (12), in which excessive corm drying reduced flower quality and productivity, utilized the following winter-growing cultivars: 'Spic and Span,' 'Valeria,' 'Elizabeth the Queen,' 'Peter Pears' and 'Friendship.'

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